**Cadmium Aquatic Life Ambient Water Quality Criteria**

**Briefing for Betsy Southerland**

**March 14, 2016**

1. **OVERVIEW**
   a. **Criteria document revision based on comments received during 60 day public comment period**

   b. **Comment letters received**
      i. Utility Water Act Group (via Hunton and Williams)
      ii. Florida Department of Environmental Protection
      iii. Hampton Roads Sanitation District
      iv. Illinois Environmental Protection Agency
      v. Wisconsin Department of Natural Resources
      vi. Kansas Department of Health and Environment
      vii. US Geological Survey (Chris Mebane)
      viii. National Marine Fisheries Service
      ix. Center for Biological Diversity
      x. California State Water Resources Control Board

   c. **Limited changes in document content occurred as a result of public comments**
      i. Acute freshwater value decreased slightly
      ii. Estuarine/marine acute and chronic values decreased
      iii. Most other revisions involved addition of clarifying tables, figures, or text

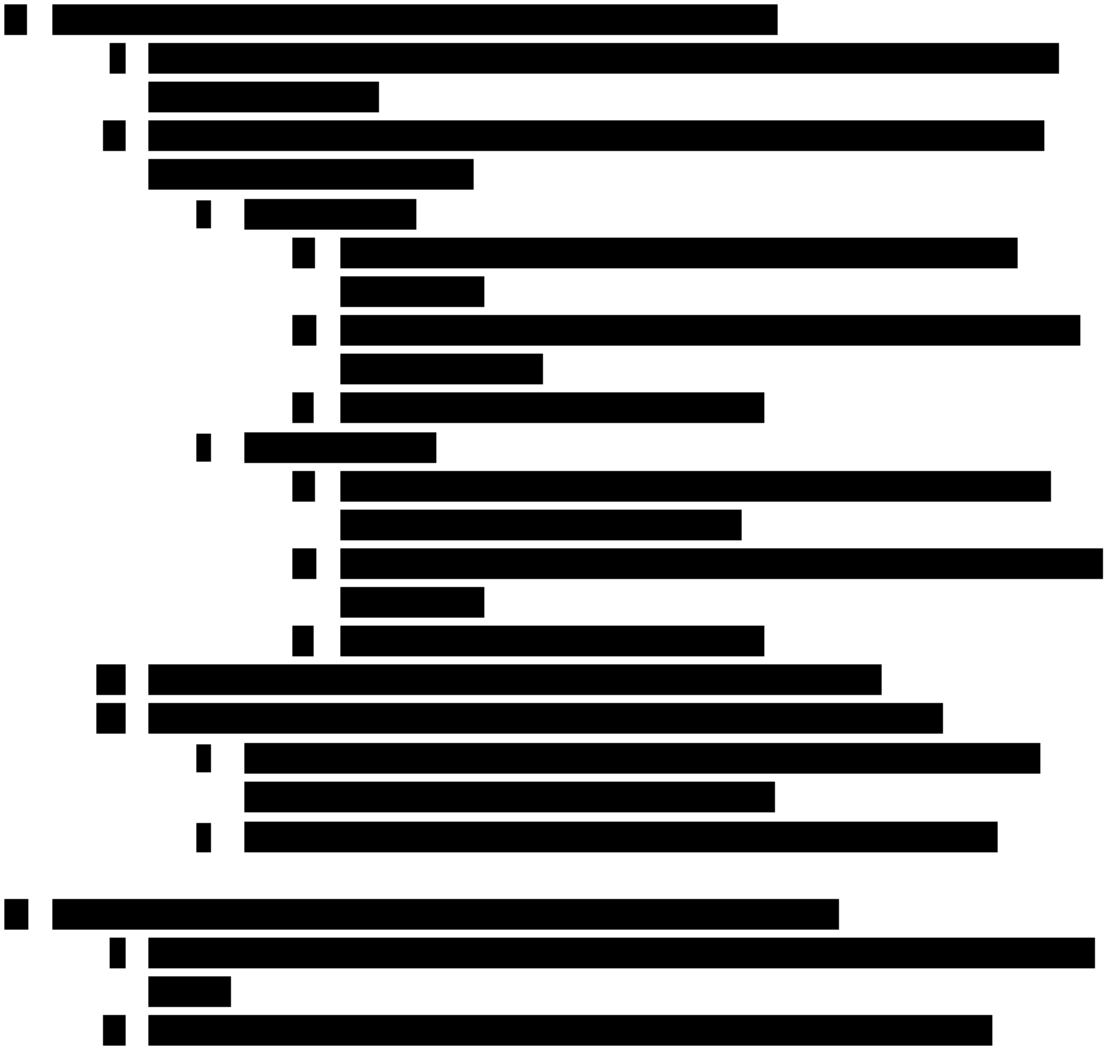
| | 2016 Revised Values | | FRN Draft Publication Values | | 2001 Criteria Update | |
|---|---|---|---|---|---|---|
| | **Acute** (1-hour, dissolved) | **Chronic** (4-day, dissolved) | **Acute** (1-hour, dissolved) | **Chronic** (4-day, dissolved) | **Acute** (1-day, dissolved) | **Chronic** (4-day, dissolved) |
| **Freshwater** (Total Hardness = 100 mg/L as $CaCO_3$) | [redacted] µg/L[a] | [redacted] µg/L | 2.1 µg/L[a] | 0.73 µg/L | 2.0 µg/L[a] | 0.25 µg/L |
| **Estuarine/marine** | [redacted] µg/L | [redacted] µg/L | 35 µg/L | 8.3 µg/L | 40 µg/L | 8.8 µg/L |

[a] Lowered to protect the commercially and recreationally important rainbow trout, as per the 1985 Guidelines, Stephen et al. (1985).

d. **Currently revising based on Agency Workgroup review**

| Action | Date |
|---|---|
| Agency Workgroup Draft Review | 4/20/15 – 5/20/15 |
| External Peer Draft Review | 8/22/15-10/2/15 |
| Agency Workgroup | 11/2/15 – 11/10/15 |
| 60 Day Public Comment Period/Revisions | 12/1/15 – 2/1/16 |
| Agency Workgroup Review of Final Document | 3/1/16 – 3/9/16 |
| FRN Publication | 3/30/16 |

## 2. KEY DOCUMENT CHANGES BASED ON PUBLIC COMMENT PERIOD



[redacted]

**d. Notable editorial changes/clarifications**

i. Information was added clarifying approach and source of data for converting total to dissolved concentrations for fresh and saltwater including
   - Data sources
   - Water and salts used for testing: Natural surface waters and cadmium chloride and cadmium sulfate salts used for simulation

ii. Footnotes edited in Appendix A and B to differentiate "Data not used to calculate SMAV because more sensitive lifestage available" from "Flow-through measured test available"

iii. Table 5 was modified to identify specific genus used to fulfill each of the family MDRs, instead of only numbers of phyla, family, genera, and species used to derive criteria

iv. Additional tables were added identifying which studies and values were used in the acute and chronic hardness normalization analysis (Appendices A-2 and C-2)

v. Graphs were added showing the freshwater acute hardness linear regressions to better illustrate the normalization process (Figures 2 and 4)

3. **KEY COMMENTS/RESPONSES WITH LIMITED OR NO REVISION**

a. **Comment #1: Change in acute duration from 24 hours to 1 hour is not adequately justified or supported by new studies and may require additional samples to be collected (UWAG)**

**i. Response**

- A one hour duration is consistent with 1985 Guidelines:
  "One hour is probably an appropriate averaging period because high concentrations of some materials can cause death in one to three hours. Even when organisms do not die within the first hour or so, it is not known how many might have died due to delayed effects of this short of an exposure. Thus it is not appropriate to allow concentrations above the CMC to exist for as long as one hour."
- One hour duration is consistent with all prior cadmium criteria revisions (1996, 1985, 1980), with the draft versions of the 2001 cadmium revision, and with all 45 of the other acute values except freshwater copper (which we are correcting)

- Changing the duration to one hour will not affect the expression of WQBELs; consistent with the NPDES regulations (40 CFR 122.45(d)) and WQBEL derivation procedures (EPA's TSD guidance) WQBELs would continue to be expressed in terms of Maximum Daily and Average Monthly averaging periods

b. **Comment #2: Proposed chronic criterion is based on a flawed toxicity test conducted on the amphipod *Hyalella azteca* (Ingersoll and Kemble 2001); which is the most sensitive organism tested (IEPA)**

   **i. Comment**

   - Criterion derivation should be repeated using newly developed feeding procedures (Soucek, paper in press) shown to result in better growth and reproduction
   - Test organisms did not attain minimum growth requirements **based on the direct measure of organism weight** (average dw of controls = 0.27 mg/individual); EPA then used length data to extrapolate to dry weight with a regression equation but provided no supporting documentation
   - **Response**

     a. Growth and reproduction is acceptable based on current guidelines

        i. Growth

           1. Average control growth = 0.524 mg dw/individual after 42 days (indicated by the regression equation)
           2. ASTM (2005) requires $\geq$ 0.15 mg dw/individual
           3. Environment Canada (2013) requires $\geq$ 0.10 mg dw/individual)
           4. Mount and Hockett recommend $\geq$ 0.50 mg dw/individual (Appendix K)

        ii. Reproduction

           1. Average control reproduction = 6.4 young/female after 42 days
           2. ASTM (2005) requires > 2 young/female
           3. Mount and Hockett recommend $\geq$ 6 young/female (Appendix K).

     b. [redacted]

   ii. **Comment 2b**

- Dilution series tested (control, 0.1, 0.3, 0.5, 2.0 and 3.0 µg/L.) did not appropriately bracket the effect concentration; a large gap in test concentration between the NOEC and LOEC (0.5 and 2.0 µg/L, respectively) led to an imprecise EC20
- **Response**
    a. Graph of response curve data indicates a break close to the 2.0 ppb treatment concentration, and sensitivity analysis suggests additional concentration would not have appreciable effect on calculated EC20

c. **Comment #3: Clarify if states have the option to adopt total Cd criteria values (FDEP, WDNR)**
    i. **Response**
        - Both dissolved and total concentrations are presented for use by states
        - EPA recommends the use of dissolved concentration, whenever possible, since it better represents bioavailable fraction

**d. Comment #4: Criteria Must Be Fully Protective of ESA Species (NMFS, CBD, CSWRCB)**
    **i. Comment 4a**
        - EPA must consult the Services in its criteria recommendations
        - **Response**
            a. EPA intends to consult with the Services when undertaking the Federal action of approving cadmium criteria submitted by the states for EPA's consideration
            b. EPA is conducting an analysis of salmonids for the [redacted] evaluation
    ii. **Comment 4b**
        - It needs to be determined if cadmium accumulation from US waters over a lifespan would reach tissue concentrations resulting in adverse effects, particularly in long lived species and/or species ingesting sediment.
            a. Long-lived omnivorous sea turtle species (i.e., leatherback, loggerhead)
            b. Long-lived species that ingest sediment on smalltooth sawfish and Atlantic, Gulf, or shortnose sturgeon species
        - **Response**
            a. Data on estuarine/marine species, particularly chronic data and data for longer-lived species are extremely limited, but cadmium is unlikely to accumulate to levels that would result in adverse effects
            b. Most aquatic organisms are considered to be more susceptible to cadmium from direct aqueous exposure than through bioaccumulation; criteria protective of direct exposure effects

are considered more applicable to the development of criteria for aquatic life